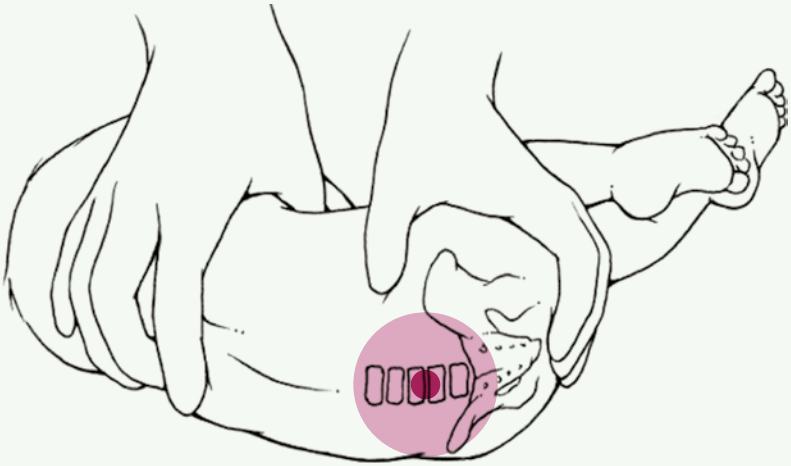
SWISS SOCIETY OF NEONATOLOGY

Percutaneous cerebrospinal fluid leak in a preterm infant following lumbar puncture



August 2017

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Title figure:
Correct positioning for LP in an infant (source: www.aap.org)

Although not routinely recommended in neonatal sepsis assessment, lumbar puncture (LP) is generally indicated in neonates with a positive blood culture, with clinical deterioration during antibiotic therapy or clinical suspicion of meningitis (1). It is generally considered to be a safe procedure (2). The most common complications reported in children are backache, headache and dysesthesia (2). All of these symptoms are transient in most cases. Other complications, such as infection, bleeding or cerebral herniation are less common but potentially more severe. To our knowledge, cerebrospinal fluid (CSF) leaks have only rarely been reported in children and neonates.

We present the case of a preterm girl born at 26 1/7 weeks of gestation secondary to chorioamnionitis. The mother had arrived at the emergency department a couple of hours before birth with high fever, abdominal pain, and advanced labor. Emergency C-section was performed because of fetal tachycardia. The girl weighed 867 g and was intubated at 5 minutes of life because of poor adaptation (Apgar scores of 4, 8 and 8 at 1, 5 and 10 minutes, respectively) and respiratory distress. She received exogenous surfactant at 1 hour of life and was transitioned to CPAP only 9 hours later.

After birth, blood cultures were obtained and treatment with amoxicillin and gentamicin was started due to the high suspicion of infection (maternal fever, preterm birth, poor adaptation, fever and fetal tachycardia). A first LP was performed at 8 hours of life because of lethargy and apnea. Cerebral ultrasound did not reveal any evidence of cerebral hemorrhage. The LP was atraumatic and revealed no signs of inflammation (CSF values: protein 1894 mg/l, glucose 2.7 mmol/l (blood glucose 4.8 mmol/l), RBC 938×10^6/l, WBC $<1 \times 10^6$/l). Blood and CSF cultures remained sterile but an E. coli was identified in a tracheal aspirate obtained after intubation, on the placenta and in the mother's urine and blood.

On day 2 of life, there was neurological deterioration with severe irritability requiring morphine administra-

Fig. 1

Percutaneous CSF leakage after LP.

tion. The cerebral ultrasound remained normal. At this point, it was decided to repeat the LP. While the intervertebral space between L3 and L4 could be entered easily, no more than 2 – 3 drops of CSF were obtained. After two more unsuccessful attempts, the procedure was stopped.

According to the nursing care protocol, a dressing was applied with 4 × 4 cm compress patches fixed with Mefix® and the infant was kept on her back for 12 hours. Fifteen hours after the second LP, during routine care, a nurse noticed a wet bed that was rapidly identified to be due to CSF leaking from the LP site (Fig. 1). Exact quantification of the fluid loss was not possible but it was estimated to be 10 – 20 ml by weighing the bed linen. The infant remained clinically and neurologically stable. Cerebral ultrasound findings remained normal.

After consultation with the neurosurgeons, conservative treatment was continued, keeping the baby in a supine position for another 24 hours with a more compressive dressing and hourly inspection of the puncture site. CSF leakage resolved within two hours and there was no recurrence. Antibiotics were stopped on day of life 10. To exclude residual CSF leakage, an ultrasound examination of the lumbar region was performed that showed no abnormalities.

The infant was discharged home at a corrected age of 7 months after several other unrelated complications (surgical necrotizing enterocolitis with short gut syndrome). At a standardized follow-up visit at a corrected age of 8 months, no neurological abnormalities were noted and neurodevelopment appeared to be normal.

DISCUSSION

Although practices can vary and controversies exist about its role in neonatal sepsis assessment, LP remains the gold standard to confirm or exclude meningitis. CSF analysis may notably help the clinician to adapt the type, doses and duration of antibiotic therapy (1), and contribute to prognosis.

To be safe, injury of the spinal cord must be avoided when performing a LP. In the neonatal period, the spinal cord reaches the level of L3. Therefore, it is recommended to enter the spinal canal between L3/L4 or L4/L5 (2) (Fig. 2).

Complications such as backache, headache, transient dysesthesia, infection, intraspinal or intracranial bleeding and brain herniation have been reported in infants and children (2). CSF leakage through the puncture site in the dura mater is a well-recognized complication in adults (3). However, leakage is mostly confined to the epidural space. According to a recent Cochrane review, the frequency of such leakages varies from 1% to 40%, in relation to needle size and bevel orientation, level of operator skills and presence of risk factors (4). In adults, CSF leakage must be suspected if the patient starts to complain about persistent headaches. It can also be associated with lower back pain, nausea, vomiting, vertigo and tinnitus (5).

In neonates, only limited information on such complications is available in the literature. One small ultra-

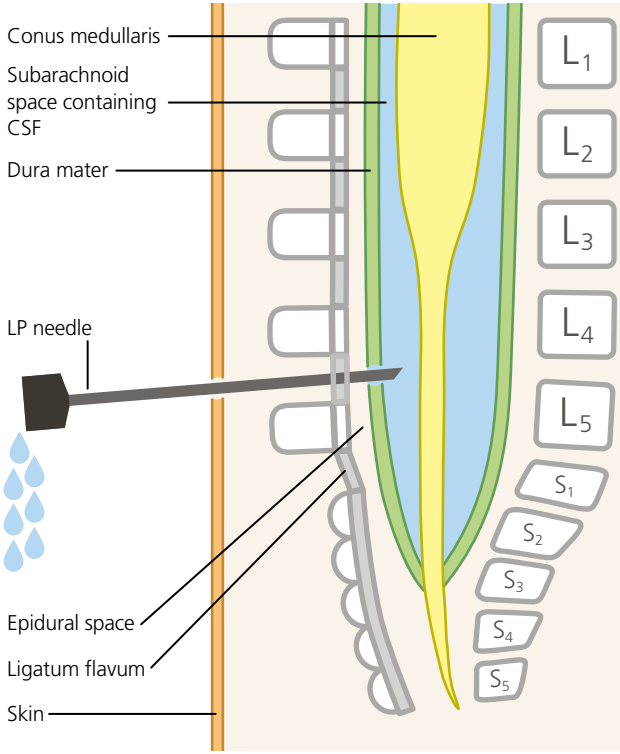

Fig. 2

Schematic drawing of LP with needle entering the subarachnoid space.

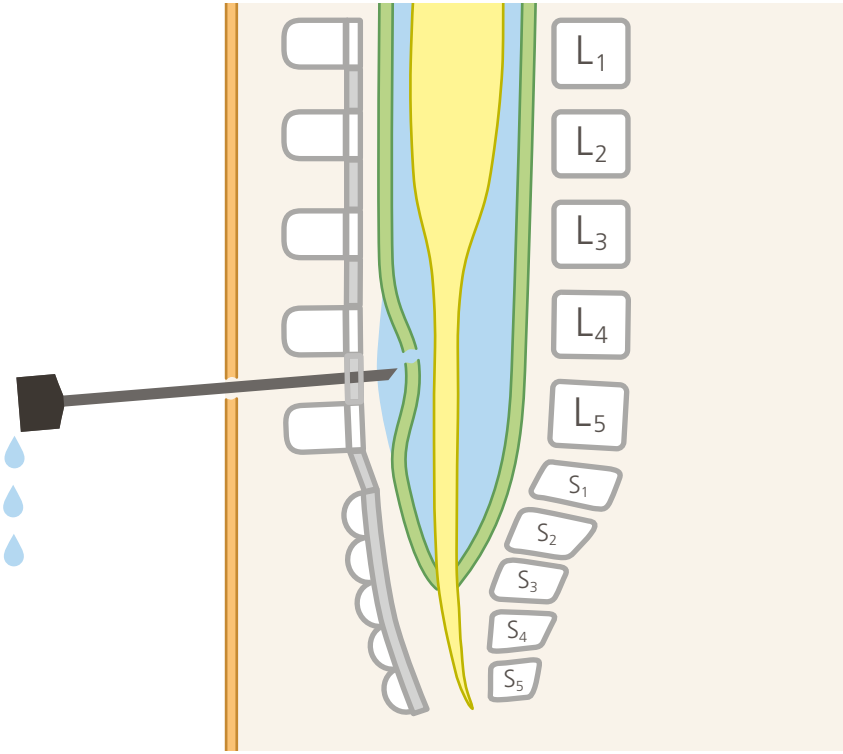

Fig. 3

Schematic drawing of LP with needle entering an epidural fluid collection.

sound study describing asymptomatic CSF leakage suggests that these are likely to be underestimated as they mostly remain undiagnosed and resolve spontaneously (6). In this study, ultrasound examination of the spinal cord was performed in every neonate who underwent diagnostic LP. Thirty-three neonates with an average gestational age of 35.9 weeks were included and they all had an ultrasound within 24 hours after the LP. Twenty-one (64%) of them had a fluid collection in the epidural space but none of them were symptomatic with a percutaneous CSF leak. Thirteen (39%) had a visible fluid collection in the epidural space without significant compression of the subarachnoid space, whereas 8 (24%) of them had a fluid collection with nearly complete compression of the subarachnoid space. Ultrasound examinations were repeated 2 to 10 days after the first one, showing full absorption of the fluid collection in all cases. The epidural collections can be explained by leakage through the puncture hole in the dura mater. Such epidural collections could also explain dripping of CSF during LP in patients who had undergone previous LP, even if the needle tip is not in the correct subarachnoid position (6) (Fig. 3).

CSF leakage management remains controversial in adults and older children (4). In milder cases, lying in a comfortable supine position and treating symptoms with rehydration, simple analgesics or opioids and antiemetics should be enough to con-

trol the symptoms (5). If symptoms do not disappear, a more specific management is required to avoid potentially severe complications. The goal of those specific therapies is to replace the loss of CSF, to seal the puncture site and to avoid cerebral vasodilatation (5). The most commonly used therapy is the introduction of a blood patch into the epidural space (5). Administration of caffeine, which seems to act as a cerebral vasoconstrictor, or surgical closure of the dural gap are the most frequently reported alternatives (5). There are no reports of specific treatments in neonates.

There are a number of measures that have been proposed to reduce the risk of CSF leakage: a) the use of smaller gauge needles (although with little evidence in pediatric studies), b) the insertion of the bevel of the needle in an acute angle to the dura mater rather than perpendicularly, in order to separate rather than to dissect the collagen fibers of the dura mater, c) the reinsertion of the stylet before withdrawing the needle, and d) the use of a blunt atraumatic needle to reduce laceration injuries of to the dura (5, 6). Interestingly, a Cochrane study in adult patients did not show any evidence that keeping patients in a supine position after a LP was effective (4). Repeating the LP 24 hours after the first one might have been the major risk factor for percutaneous CSF leakage in our patient (6).

Finally, we could not find any published information about management of CSF leakage in neonates.

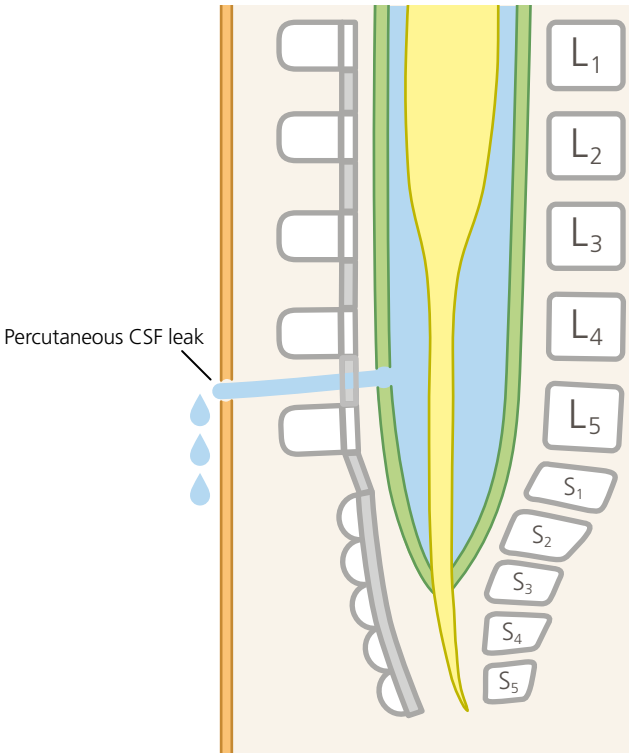

Fig. 4

Schematic drawing of percutaneous CSF leakage after LP.

Neither blood patch nor surgical interventions have been conceivable in our extremely low birth weight patient. Fortunately, a compressive dressing of the puncture site was sufficient to stop the leakage.

CONCLUSION

CSF leakage following LP is well described in adults and older children but little is known about this complication in newborns and infants. Although probably rare, percutaneous CSF leakage must be considered a significant complication of LP. It needs to be integrated into assessment of the risk-benefit ratio when deciding to perform and/or to repeat LP during the first days of life in very preterm infants. Careful monitoring of the local dressing is always indicated.

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